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THE POSSIBILITY OF UTILIZING GAS
FROM COAL DEPOSITS IN THE USSR

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Coal seams contain huge quantities of gas not inferior to gas found in gas and petroleum-gas deposits. The amount of methane liberated at the present depth of working deposits consists, in terms of energy, of more than 10 percent of the coal being mined. As mines are deepened, this figure will reach 15-20 percent. Therefore, it is quite in order to speak of gas-coal deposits. These must be regarded as complex deposits, and their particular characteristics must be taken into account in carrying out geological exploratory work, in verifying reserves, and in planning workings.

The daily liberation of methane in the gassiest mines of the Donbass amounted to 35,000 cubic meters in 1932 and had risen to 80,000 cubic meters in 1938. During the past 10 years, the daily maximum liberation of gas in certain Kuzbass mines has increased from 23,000 to 35,000 cubic meters, and in Karaganda mines from 5,000 to 24,000 cubic meters. The total daily yield of methane from Donbass mines for prewar years was 1,200,000 cubic meters. At present, 150,000 cubic meters of methane per day are liberated in both the Kuzbass and Karaganda mines.

The total yield of methane per day from all the coal mines of the USSR is approximately 2 million cubic meters. It is to be expected that this amount will increase greatly as lower levels are worked and as operations are started in coal deposits with a high gas content (Kuzbass, Karaganda, and elsewhere). All this gas is at present being irrevocably lost in the atmosphere, while it could be utilized as a source of power.

Coal as a gas collector has certain specific peculiarities as compared with other minerals. In the first place it is not negative in relation to the gas but takes up a considerable amount of it by virtue of its adsorptive capacity. One gram of Donbass or Kuzbass coal under normal conditions (temperature, 0 degree centigrade; pressure, one atmosphere) takes up 4 to 6 cubic centimeters of methane, i.e., one cubic centimeter of coal holds 5 to 8 cubic centimeters of methane. This gas is concentrated in the form of a

- 1 -

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film on the surface of the coal and in the pores of the coal seam. As gas pressure increases, the adsorptive gas increases too, but to a lesser degree than the amount of the gas in a free state in the pores of the coal seam. The amount of gases in a free state increases and that of adsorptive gases decreases in proportion to the depth of the deposits. The adsorptive capacity of coal depends also on temperature (decreases with an increase in temperature), moisture (increases with an increase in moisture), and on the degree of metamorphism (the greater the degree of carbonification, the greater the adsorptive capacity).

The second peculiarity of coal seams as gas collectors is their usually low gas permeability as compared with petroleum-gas deposits. The zone of gas seepage in the vicinity of uncovered coal seams will be very slight. Gas permeability becomes progressively less, going from slightly metamorphosed coal to anthracite.

As for origin, gas deposits are divided into primary, secondary, and mixed types. Primary deposits are those in which the gas impregnating the coal seams is the product of metamorphism of the coal substance and consist of practically pure methane. Secondary deposits are those where the gas has migrated from lower productive levels or from great depths. The principal coal deposits of the USSR contain primary gases, practically pure methane.

Usual methods of exploiting gas deposits can hardly be used for gas-coal deposits because of the slight gas permeability of the coal and rock. Small-diameter boreholes yield a relatively small amount of gas. The gas liberated in development workings is also relatively slight. A better result can be obtained from drilling a thick network of drainage boreholes along the coal seams. This seems to be a costly procedure. However, this method would be profitable, at least in some cases, if one takes into account not only the cost of the gas but the saving in the capital outlay expended by degassing coal seams before they are worked.

Best results in gas yield are to be obtained from a combined method, drilling of drainage boreholes and working of the coal seams. In one such case, one of the boreholes cut three contiguous coal seams with a total thickness of 4 meters. When these seams were worked, 15,000 cubic meters of gas per day were liberated. Seven months after the mine face had been removed, the amount of gas diminished and became stabilized at 600 cubic meters per day. Then layers in a second lower coal seam were worked and the gas yield rose again. When the mine face was under the borehole, 3,000 cubic meters of gas per day were liberated. When the mine face had advanced to 38 meters from the borehole, this figure had risen to 9,000 cubic meters per day. Prolonged observations indicate that the gas yield reaches its peak when the mine face is 35-45 meters from the borehole.

Fifteen boreholes ranging from 30 to 45 meters in length yielded 3,264,000 cubic meters of pure methane in a year in one mine where the gas was exploited by drilling boreholes, and at the same time by working the seam.

Preliminary degassification of coal seams and the surrounding rock may be carried out by drilling boreholes which either cut or run along the coal seam in cases where gas permeability is relatively high. Where the gas permeability of the seam is low, drilling of boreholes should be undertaken in combination with working of the coal seam to be degassed.

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